

Coiled Brine Recovery Assembly (CoBRA): A New Approach to Recovering Water from Wastewater Brines

Brine water recovery represents a current technology gap in water recycling for human spaceflight. The role of a brine processor is to take the concentrated discharge from a primary wastewater processor, called brine, and recover most of the remaining water from it. The current state-of-the-art primary processor is the ISS Urine Processor Assembly (UPA) that currently achieves 70% water recovery. Recent advancements in chemical pretreatments are expected to increase this to 85% in the near future. This is a welcome improvement, yet is still not high enough for deep space transit. Mission architecture studies indicate that at least 95% is necessary for a Mars mission, as an example. Brine water recovery is the technology that bridges the gap between 85% and 95%, and moves life support systems one step closer to full closure of the water loop. Several brine water recovery systems have been proposed for human spaceflight, most of them focused on solving two major problems: operation in a weightless environment, and management and containment of brine residual. Brine residual is the leftover byproduct of the brine recovery process, and is often a viscous, sticky paste, laden with crystallized solid particles. Due to the chemical pretreatments added to wastewater prior to distillation in a primary processor, these residuals are typically toxic, which further complicates matters. Isolation of crewmembers from these hazardous materials is paramount. The Coiled Brine Recovery Assembly (CoBRA) is a recently developed concept from the Johnson Space Center that offers solutions to these challenges. CoBRA is centered on a softgoods evaporator that enables a passive fill with brine, and regeneration by discharging liquid brine residual to a collection bag. This evaporator is meant to be lightweight, which allows it to be discarded along with the accumulated brine solids contained within it. This paper discusses design and development of a first CoBRA prototype, and reports initial test results.